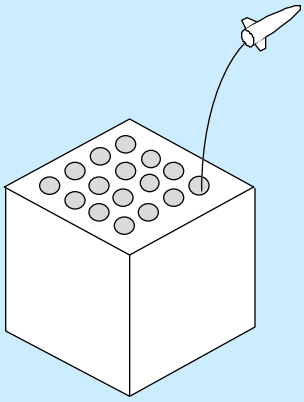
ADVANCED FIRE SUPPORT SYSTEM (AFSS)



"Out of the Box"

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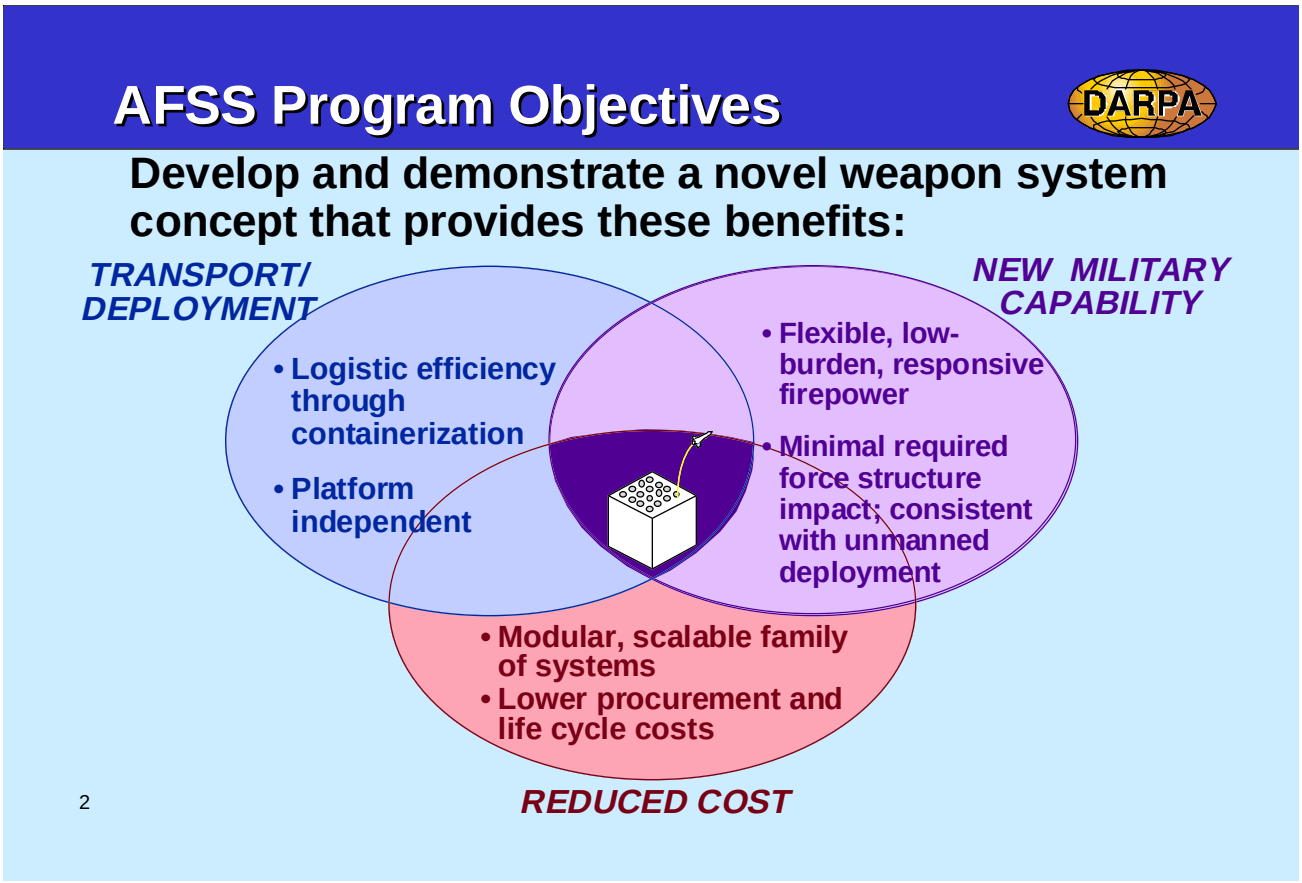
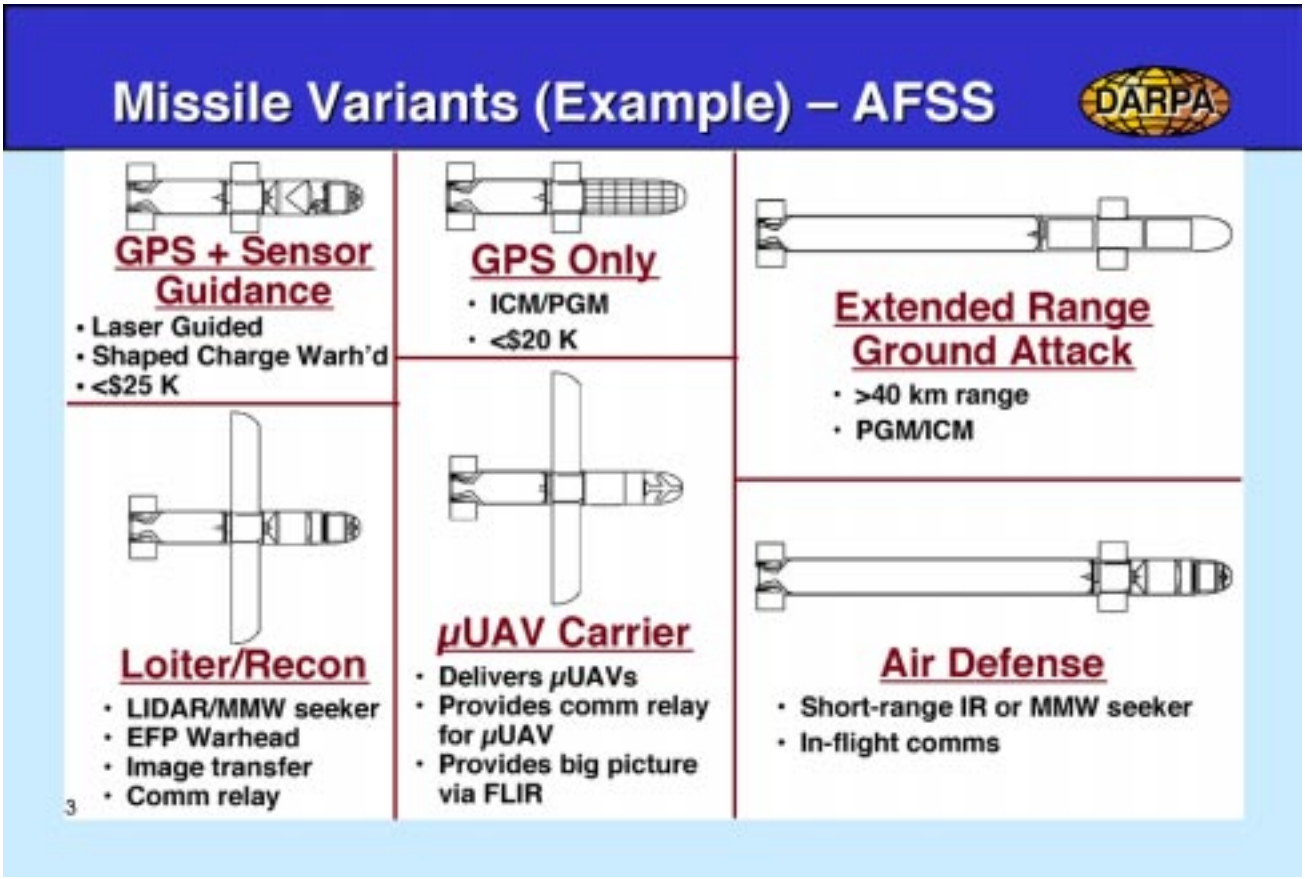


The Advanced Fire Support System (AFSS) concept is a family of small, containerized, platform-independent, indirect-fire weapon systems capable of performing a variety of missions such as ground attack, air defense, and surveillance, and that can be remotely fired and robotically deployed in a variety of military scenarios.

The AFSS program has three key objectives:

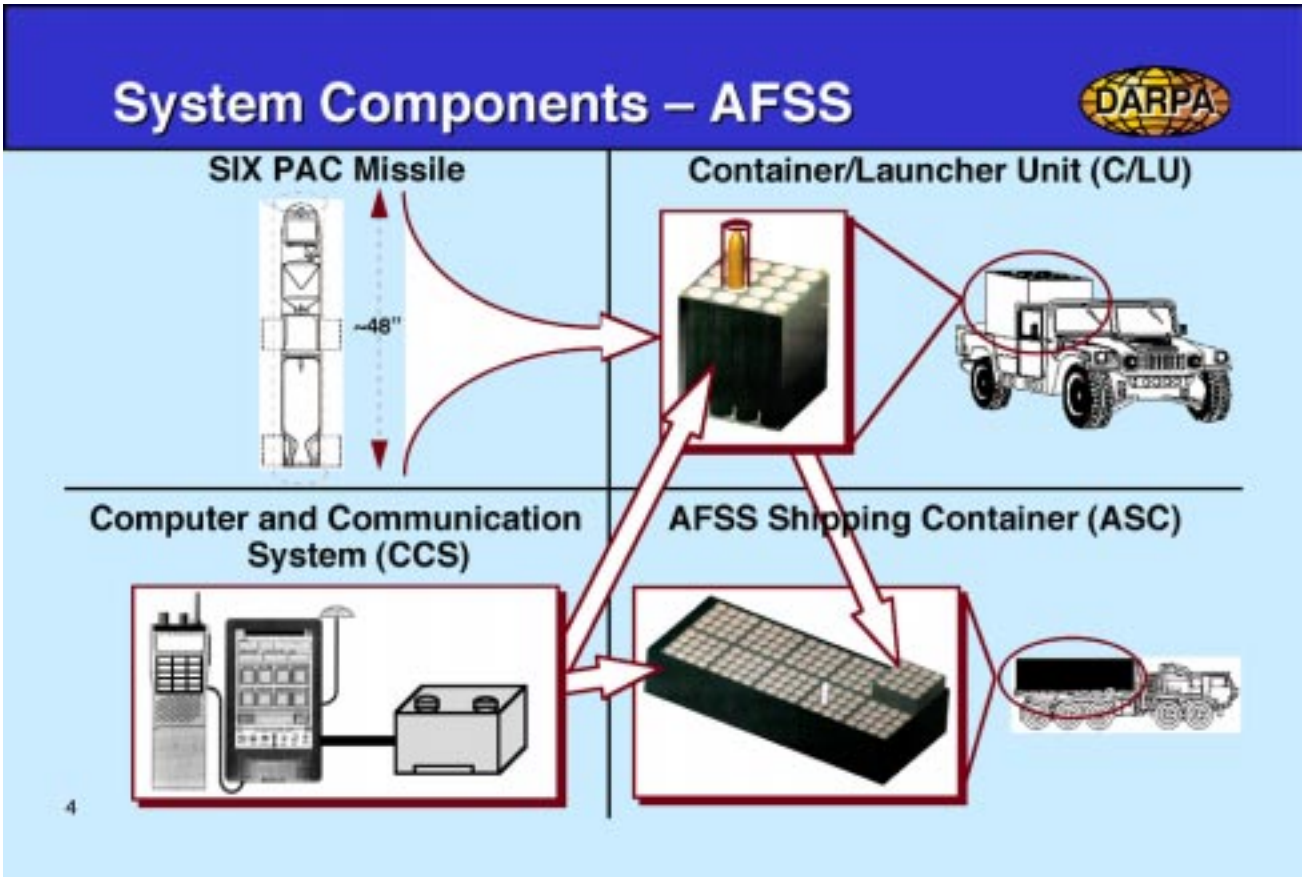
- Simplified Transport and Deployment. AFSS emphasizes the concept of containerization, which provides an integrated approach to land, sea, and air transport via standardized containers. The containerized missiles extend the "wooden round" concept to another dimension. Individual AFSS missiles do not need to be handled separately and require no maintenance in the field. The containers are low-cost and may be temporarily left behind when expended.
- Provision of a New Military Capability. The AFSS concept allows military missions to be approached in a new way. Because of their ease of transport and ability to launch via remote control, AFSS is extremely flexible in its potential scope of operations. It can be fired directly from a truck, a ship, or directly from the ground and can be air-dropped into remote locations. Its burden to the operating unit is low because of its logistic efficiency and because it can be operated using a radio and a small target locating device resembling a pair of binoculars. The short time-of-flight, long range, and high rate of fire provide the responsiveness to deal with a wide range of situations. The AFSS system should have little or no impact on force structure requirements because it requires no dedicated personnel or material assets.
- Reduced Cost. Low system and life cycle cost is an explicit goal of the AFSS program. This will be achieved in three ways. First, the program will emphasize low-cost design approaches and will use cost as an evaluation factor. Second, modularity and scalability will be maximized to allow most of the components and infrastructure to address a variety of missions. This will increase the production base and lower system cost. Third, the simplified storage, transport, maintenance, and manpower requirements should dramatically lower life cycle cost.



The AFSS concept includes a wide variety of missions and missiles using common infrastructure and components. Examples of possible variants are shown here. A small (~ 4') ground attack version of AFSS is shown at the upper left. As will be discussed later, it is sized to accommodate deployment via HMMWV or helicopter. It employs GPS/INS guidance, a semi-active laser seeker, and a large warhead. The production cost goal is $25,000 per round. This version can be used in a manner similar to direct fire weapons such as TOW or Javelin, but has a much lower physical load for the soldier/operator (i.e., a targeting device similar to a pair of binoculars), has much longer range (~ 15 km), and can supply a greater rate and volume of fire. To its right is a low-cost variant of this system employing bomblets or submunitions for use against soft targets. Below these are winged variants that can fly and loiter like a small aircraft. These systems can provide imagery and/or targeting information back to low-level commanders and can either attack along a specified route and location, as shown at the lower left, or can dispense a payload and continue to function as a communication relay, as shown to its right.

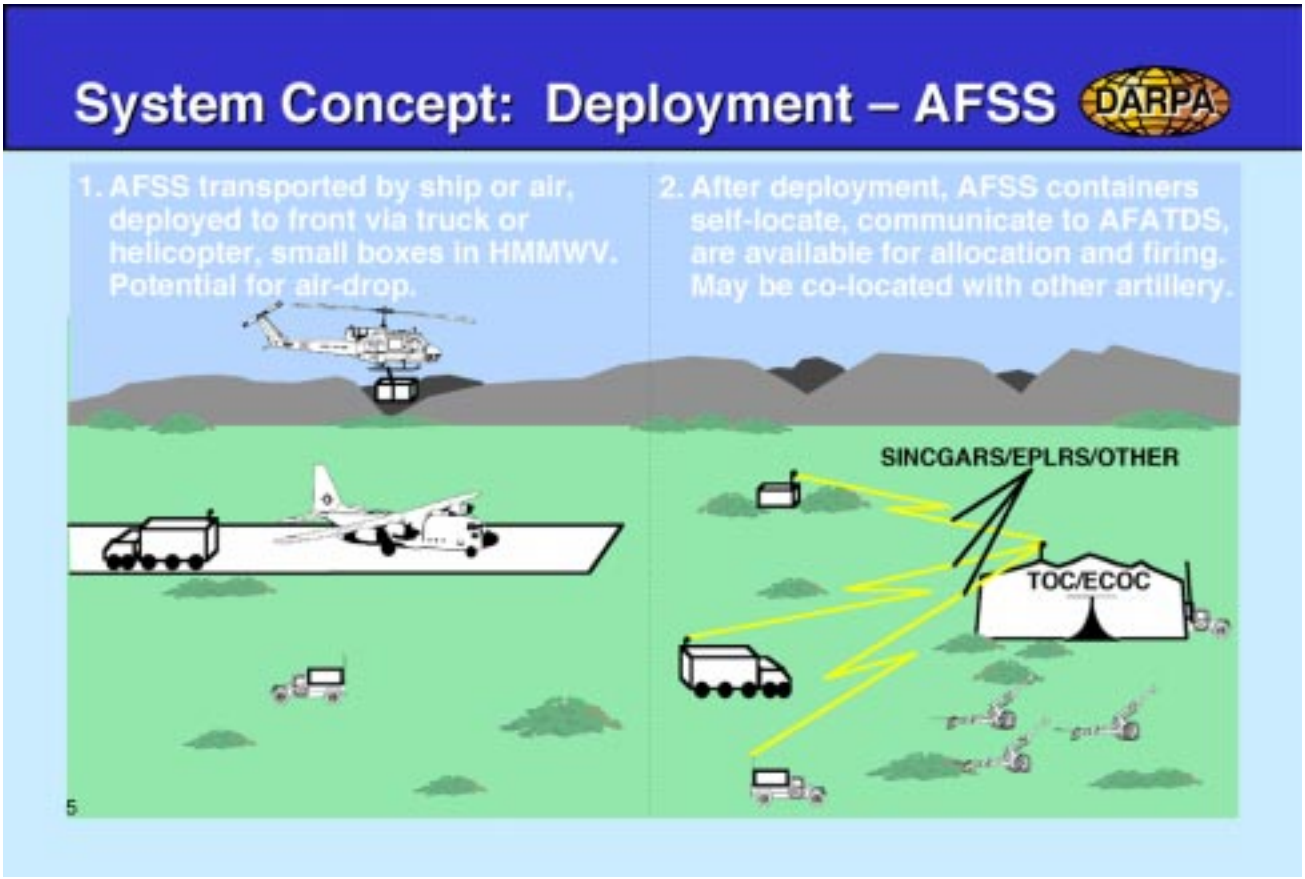
Larger (~ 7') versions of AFSS are shown in the two right-hand frames. The extended range ground attack system is essentially a stretched version of the small ground attack missile with a longer motor and warhead section. This will allow greater range and increased flexibility in warhead selection. However, the longer time of flight may make it advantageous to use smart submunitions because of the potentially larger position uncertainty for moving targets. The air defense variant envisions using a large motor for minimum flight time and in-flight communications from the targeting sensor to provide mid-course guidance. This will allow the use of a relatively inexpensive short-range seeker for terminal engagement.

All these systems can be vertically launched directly from a standard-size shipping container; all use the same communication, fire control system, and navigation unit; and all use similar motors and flight controls.

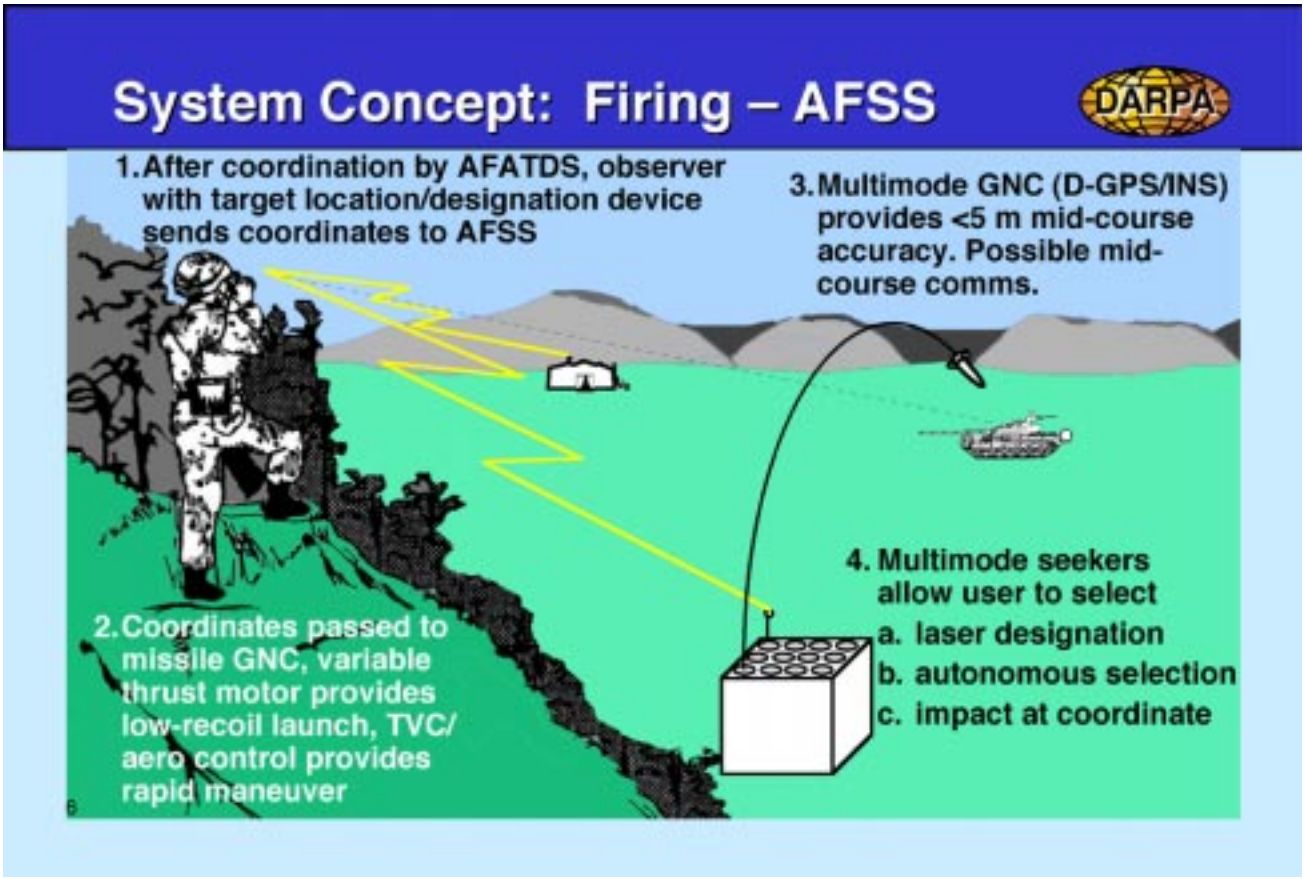


This chart depicts the major components of the AFSS system for a notional small ground attack variant called SIX PAC (Small, IneXpensive Precision Attack Container). It consists of four major items:

- The SIX PAC Missile. This is similar to the small ground attack missile discussed earlier. It is packaged inside a protective launch tube and is expected to weigh approximately 50 kg with dimensions of approximately 48 inches high and 7–8 inches in diameter. It will have a range of approximately 15 km and a maximum time-of-flight of approximately 60–90 seconds.
- The Container/Launcher Unit (C/LU). The purpose of this item is to provide low-level tactical deployment of the small AFSS missiles. The C/LU is approximately 4' x 4' x 5' (high), contains at least 15 AFSS missiles, and weighs approximately 1300 kg. It is designed to be transported in a heavy HMMWV, UH-60, or V-22. AFSS missiles may be fired directly from the C/LU.
- The AFSS Shipping Container (ASC). This is similar to a standard ISO shipping container, weighs < 15,000 kg, and will use standard shipping systems specifically including the Palletized Loading System (PLS), Logistics Vehicle System (LVS), and C-130. For the small AFSS missiles (as shown here), it will be shorter than a standard ISO container and will contain 8–10 C/LUs. AFSS missiles may be fired directly from the ASC, or C/LUs may be downloaded to other vehicles using a small crane or winch via a drop-down tailgate.
- The Computer and Communication System (CCS). This is a small modular system that controls the operation of the AFSS system from activation through missile launch. It consists of a small computer, a communication device, a power supply, and a position/orientation system. It will control built-in test, container self-location, communication with fire control systems, firing code validation, tamper detection, and other functions. It is intended to be small, low-cost, and low-power. In the future, it may be a multiple-use system such as an Army Applique computer or USMC DACT.



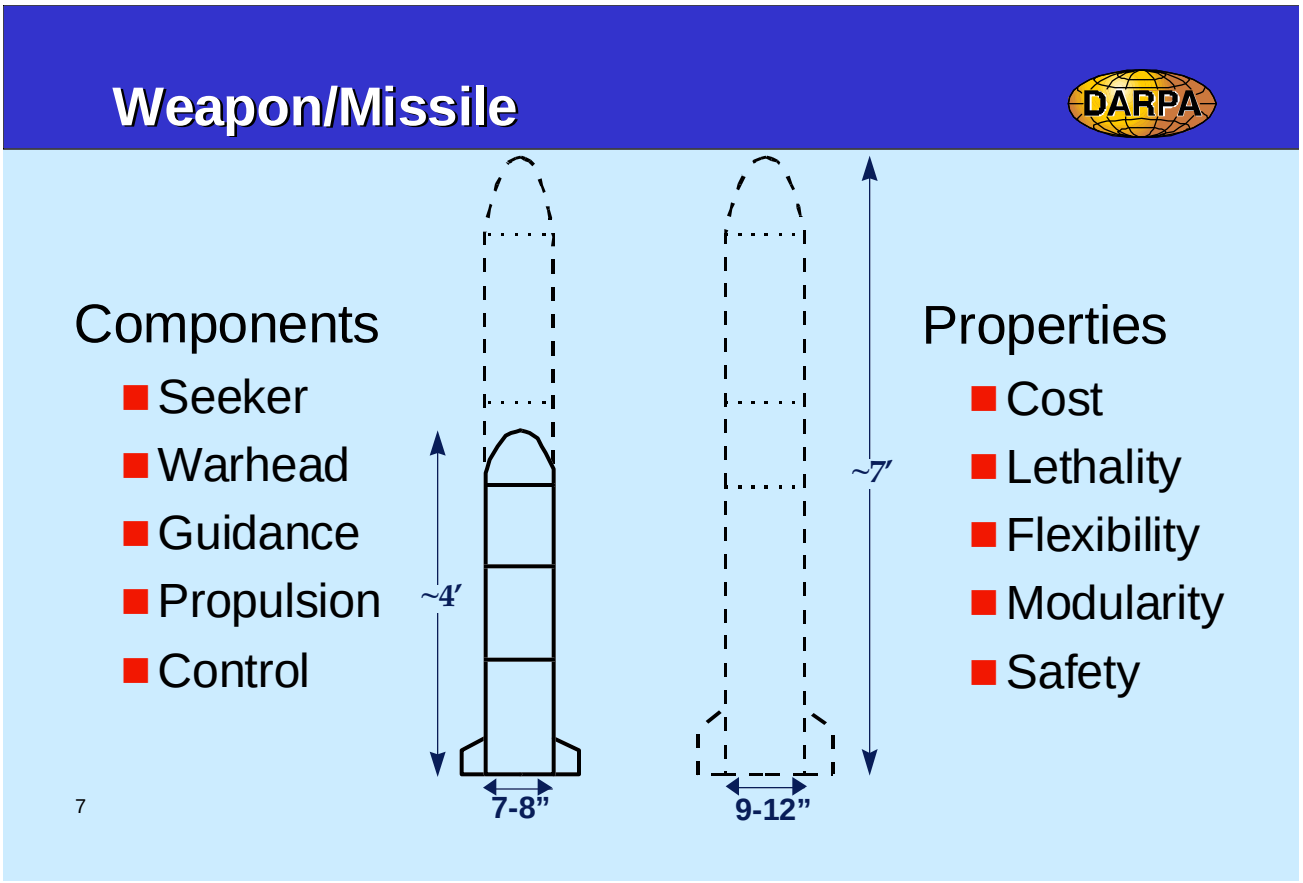
The concept of operations for initial deployment of AFSS is shown here. AFSS will be transported into theater via ship, aircraft, truck, or train in the AFSS shipping container (ASC), which is essentially a standard ISO container. The ASC may then be placed on a truck (either commercial semi-tractor or military cargo system), and deployed forward, placed on the ground for local use, or (for small AFSS missiles) smaller Container/Launcher Units (C/LUs) may be downloaded to heavy HMMWVs or helicopters. Once activated (via attachment of the computer and communication system), the units will initialize, self-locate, and establish communications with a fire control center. A fire control system such as AFATDS will note the location status and type of unit and will control the allocation of specific requests for fire. This may be done either on a request-by-request basis or by using a pre-request allocation plan. Depending on the type of missile and intended mission, AFSS may be co-located with artillery units or may be organic to maneuver units.



The envisioned firing sequence for a ground attack version of AFSS is shown here.

Certain soldiers would be equipped with a radio and target location and designation device such as the AN/PEQ-1A, which is essentially a pair of binoculars with a GPS, azimuth/elevation sensor, and laser ranger/designator. When a target is observed, a request for fire is sent via digital message to a fire coordination system such as AFATDS. If the request is accepted, missiles will be allocated to the mission. Alternatively, missiles may be pre-allocated. When the soldier has determined an accurate target location and is ready to fire, the target coordinates and appropriate mission information (such as designator codes) are transferred to the appropriate missile(s), and a launch command is issued. Depending on the evolution of doctrine, this may be done by the fire direction system or by the soldier himself. Upon launch, a message is sent to the soldier announcing the launch, the expected time of impact, and if required, the time to begin laser designation.

When a launch command is received, the missile activates its electronics, computes a flight path, initializes its IMU, and downloads GPS initialization data from the Computer and Communication System, all within 5–10 seconds. Simultaneously, the container issues a low-level launch warning to alert any nearby personnel. The missile is then vertically launched using a safe “soft launch” technique, oriented to its flight direction, and thrusted toward its objective. A high accuracy navigation system such as differential GPS/INS provides guidance to the original target coordinate. The solider may override this with a laser designation or, in more advanced variants, autonomous seekers may be used.



This chart summarizes the components and challenges of the AFSS missile. General properties of all AFSS missiles are shown on the right.

- Cost. The system must be designed with low system cost as a continuing goal.
- Lethality. Lethality must be sufficient against targets including tanks, other material, bunkers, buildings, and personnel. A single type of warhead is desired for logistic simplicity.
- Flexibility. The system must be flexible enough to accommodate a broad range of missions, scenarios, and potential firing platforms such as ships, aircraft, and moving vehicles.
- Modularity. Modularity includes the ability to fire a variety of AFSS missile variants from the same launchers and also the ability to use alternative seekers, warheads, and motors in a common frame. Scalability among long (~ 7') and short (~ 4') versions of AFSS will also be examined to determine the benefits of a common diameter versus varied diameters.
- Safety. The system must be capable of being fired from a variety of vehicles, ships, and perhaps aircraft, possibly with personnel in the vicinity. If impacted, it must not explode or produce toxic materials.

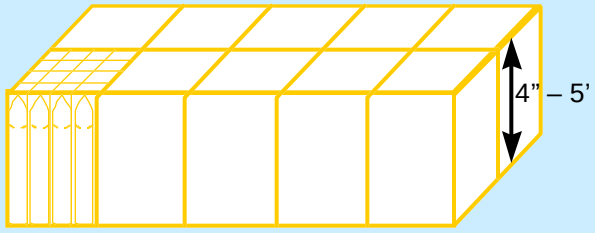
Major components must be optimized for cost and performance. These include various seeker options, which may include laser semi-active seekers, autonomous seekers, or hybrids; warheads that may use one mode against tanks and another against soft targets; guidance systems providing high accuracy, robustness, and low cost; propulsion systems that minimize time-of-flight with low hazard and soft launch capability; and control systems that provide the agility to accommodate high accuracy and short flight times to both minimum and maximum ranges.

All component trades must be analyzed in a system context and a tradeoff methodology established that heavily emphasizes low cost.

Launcher/Control

Components

- Structure
- Power
- Position/ Orientation



Properties

- Cost
- Weight
- Strength
- Reliability
- Survivability

Launcher should be compatible with a mix of weapons

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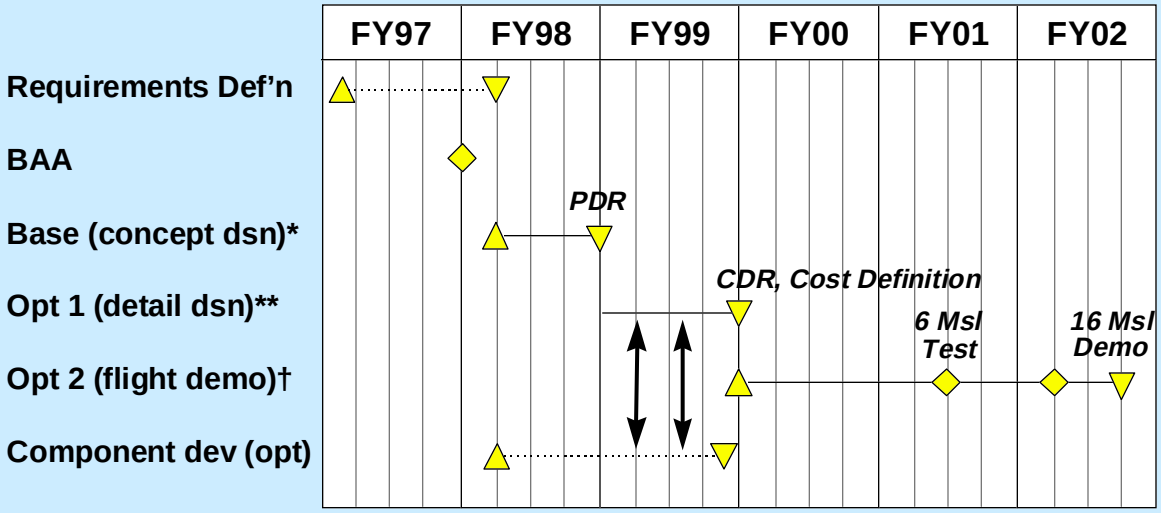
The key issues for the launcher units (both large and small) are shown at the right. Cost is an issue because the launchers may not be recovered. Their weight must be minimized for logistic efficiency. The container/launchers must stand up to the rigors of shipping, including container stacking 2–3 high, and of long-term storage and field use, including salt spray and weather extremes. The system must protect the missile to achieve high mission reliability and must have software logic that detects malfunctions and provides both status reports and alternatives.

The system components include the structure itself, which must be optimized for strength, low weight, and low cost; the power supply alternatives and electronic interconnections between the container, any subcontainers, and the missiles; and the self-positioning and orientation capabilities sufficient to allow missile functioning.

All component trades must be analyzed in a system context and a tradeoff methodology established that optimizes logistic efficiency, ease of use, and low cost.

Schedule – AFSS



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This chart and the next describe the AFSS program plan. The intent is to issue a Broad Agency Announcement covering three topics: Topic A—baseline AFSS design and demonstration, Topic B—high payoff component development, and Topic C—near-term AFSS demonstration. Multiple awards are anticipated.

Topic A: AFSS Baseline Design and Demonstration (FY 98-02). This topic consists of a basic concept definition effort and three options. Option costs shall be definitized prior to exercise of the options. The basic effort of approximately 8 months duration ending October 1998 is for identification of high value missions and requirements; clarification of operational requirements and translation to technical requirements; quantification of military benefits; definition of top-level trades and key issues; determination of alternative approaches and definition of an evaluation methodology; preliminary system design concluding with a preliminary design review (PDR), including drawings, weight and power budget information flow, and components and service; and definition of a low-cost approach to production of a family of related missiles and missions.

Option 1: System Detailed Design. If exercised, this option is for approximately 12 months ending October 1999 and shall include detailed system design, risk reduction, and demonstration of key components. During this phase, the contractor shall define the system concept in detail, define system trades and assessments including assessment of components being developed in Topic B (below) and execution of interface control documents as required; define the technical risk and a risk reduction plan; develop and demonstrate critical components such as seekers, guidance/navigation units, and other key components; perform detailed system simulations beginning with 6 degree-of-freedom flyouts and progressing to hardware-in-the-loop testing; define system cost breakouts for all elements; further define cost reduction strategies for production, and support quarterly technical reviews and a critical design review (CDR).

Continued

Option 2: System Fabrication and Test. If exercised, this effort is for approximately 24 months ending July 2002 and shall include development and demonstration of the complete AFSS system. During this phase, all components will be demonstrated in a series of increasingly integrated tests including hardware-in-the-loop, approximately six full-up flight tests, and culminating in full system demonstration of approximately 16 AFSS missiles in the January–June 2002 timeframe.

Business Opportunities

Full system development

- launcher
- munitions
- system tests

Subsystem development – looking for proposals for AFSS components including

- seekers/designators
- warheads
- guidance and control
- propulsion

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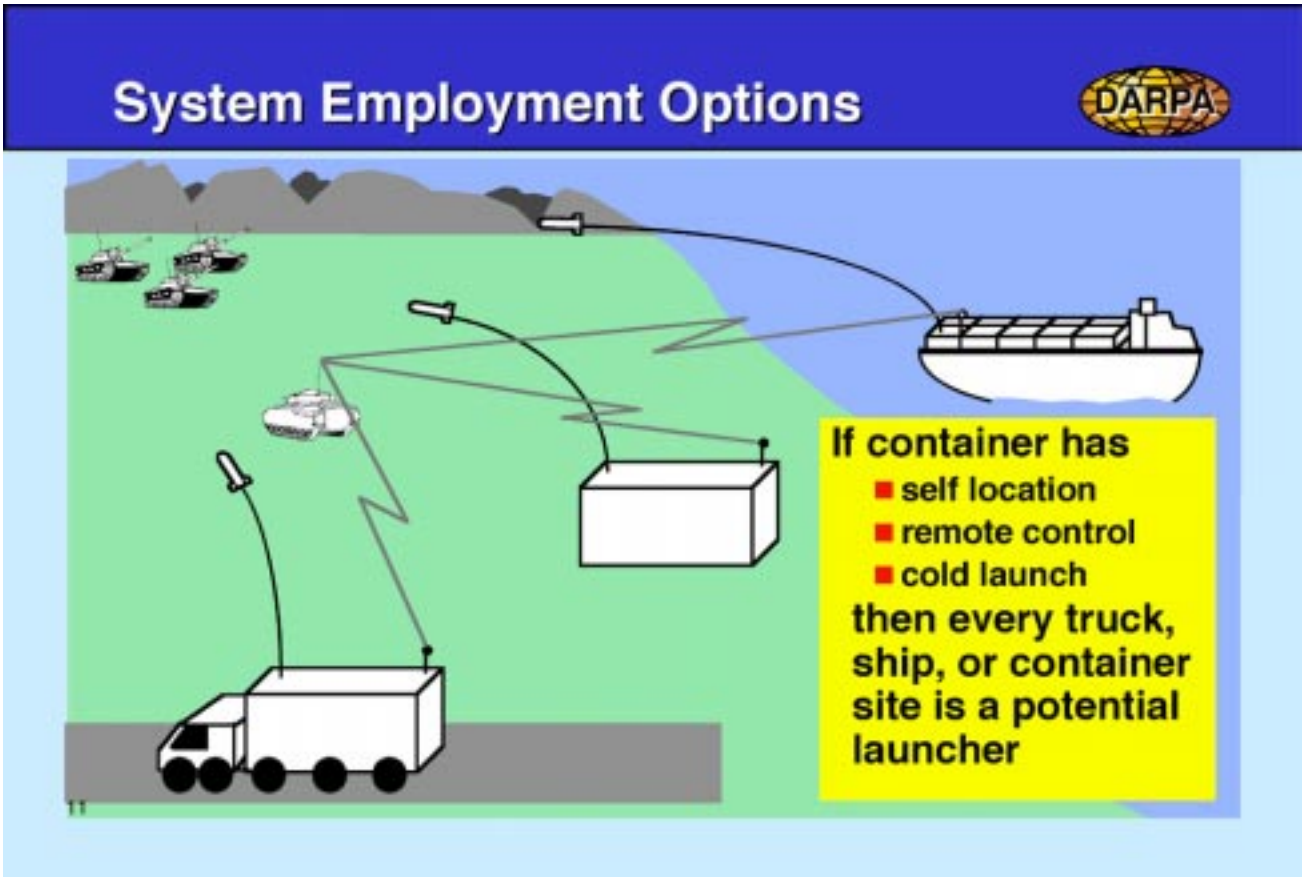
Topic B: AFSS Component Development (FY 98/99, ~ 20 Months). This topic is for development and demonstration of novel, high payoff components supporting either cost reduction or performance enhancement of the AFSS concept, such as low cost seekers, navigation systems, frequency-agile laser designator and seeker systems, or other performance-enhancing or cost-reducing components. The contractor shall support component development, realistic testing and demonstration, and shall develop a plan for integration of the component into an AFSS missile. Components developed in this topic are intended for inclusion in Topic A systems during system design and fabrication. Successful Topic B contractors must interface with Topic A contractors for transition of their components into Topic A systems.



The AFSS concept has a large potential impact on the way small missiles are built and employed. While it is not intended to replace either direct fire weapons or tube artillery, it can provide a low-burden, high volume precision kill supplement, which can be of high value in a variety of missions. Examples include

- Early Entry. AFSS can provide critical firepower during the early entry phase of a battle when heavy systems have not yet arrived.
- Light Force Operations. AFSS can provide greater range and volume of fire with little operational burden to supplement systems such as Javelin or TOW.
- Defense/Withdrawal. AFSS can provide a high target servicing rate by cross-firing for units under attack and can be caused to fire automatically or in response to sensors to cover a withdrawal.
- Special Operations. Small man-handleable AFSS launchers with 1–4 missiles could provide strike capability from an insertion point or could be air-dropped deep in enemy territory.
- Future Concepts. AFSS missiles could be cued and directed by unmanned assets such as UAVs or UGVs.

In summary, AFSS can provide a supplement to existing capabilities and doctrine at a low cost and small operational burden, but it can also enable more revolutionary concepts of operation that stress efficient logistics, rapid movements, and dispersed operations. It can be stored for extended periods, is easily transported and deployed, is combat-ready immediately, and requires little maintenance and training.

In addition, AFSS offers a strong new approach to affordability due to the potential for commonality among a wide variety of small missiles. If fully exploited, the family of AFSS missiles can provide a highly cost-effective solution to a wide variety of current and future battlefield requirements.